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What is claimed and desired to be secured by United States Letters Patent is:

1. A method for forming an oxide region on a substrate assembly, the method comprising:

bombarding a selected region of a volume of semiconductor material substantially composed of a first material with ions of said first material, said volume of semiconductor material substantially composed of said first material being situated on a substrate assembly; and

oxidizing said first material in said selected region.

2. A method as recited in Claim 1, wherein bombarding a selected region of a volume of semiconductor material substantially composed of a first material with ions of said first material leaves unaltered the electrical charge characteristics of the first material within the selected region.

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3. A method as recited in Claim 2, wherein the ions of said first material comprise silicon ions.

4. A method as recited in Claim 3, wherein said first material is substantially composed of monocrystalline silicon.

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5. A method as recited in Claim 1, further comprising:

forming a hard mask on a top surface of the volume of semiconductor material prior to said bombarding a selected region of a volume of semiconductor material substantially composed of a first material with ions of said first material; and

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subsequently forming an opening in the hard mask to expose the selected region, the ions of said first material being implanted through the opening in the hard mask into the selected region.

6. A method as recited in Claim 5, further comprising forming a spacer around the opening of the hard mask, said spacer extending from the volume of semiconductor material substantially composed of the first material to make contact with the hard mask, wherein bombarding a selected region of a volume of semiconductor material substantially composed of a first material with ions of said first material implants said ions of said first material immediately adjacent to but not through the spacer around the opening in the hard mask.

7. A method as recited in Claim 6, wherein forming a spacer around the opening of the hard mask further comprises:

depositing a layer of spacer material over the opening in the hard mask; and

anisotropically etching the layer of spacer material over the opening in the hard mask to form the spacer around the opening in the hard mask.

8. A method as recited in Claim 7, wherein the layer of spacer material is composed of silicon nitride.

9. A method as recited in Claim 7, wherein the spacer is one of a pair of spacers through which the ions of said first material are implanted between but not through the pair of spacers around the opening in the hard mask and into the selected region, wherein the selected region is situated between the pair of spacers.

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Docket No. 11675.107

10. A method as recited in Claim 9, wherein the pair of spacers are separated by a distance in the range from about 0.05 micrometers to about 0.1 micrometers.

11. A method as recited in Claim 1, further comprising the steps, prior to said bombarding a selected region of a volume of semiconductor material substantially composed of a first material with ions of said first material, of:

forming a pad oxide layer over the volume of semiconductor material substantially composed of the first material;

forming a nitride layer over the pad oxide layer;

forming a photoresist mask over the nitride layer; and

selectively removing the nitride layer through the photoresist mask to expose an opening to the volume of semiconductor material substantially composed of the first material at the selected region, wherein the first material is oxidized in the selected region within the opening to the volume of semiconductor material substantially composed of the first material.

12. A method as recited in Claim 11, wherein the photoresist mask is removed after said bombarding a selected region of a volume of semiconductor material substantially composed of a first material with ions of said first material.

13. A method as recited in Claim 11, wherein said selectively removing the nitride layer through the photoresist mask includes selectively removing the nitride layer (through the pad oxide layer).

Docket No. 11675.107

14. A method as recited in Claim 1, wherein the substrate assembly is oriented in a major plane and the ions of said first material are implanted into the selected region in a direction that is within ten degrees from a direction that is orthogonal to the major plane of the substrate assembly.

15. A method as recited in Claim 1, wherein oxidizing said first material in said selected region further comprises heating the substrate assembly while exposing the substrate assembly to oxygen.

16. A method as recited in Claim 1, wherein the volume of semiconductor material substantially composed of said first material is composed of a monocrystalline material having a lattice structure, wherein the implanted ions of said first material in the monocrystalline material cause the lattice structure of the monocrystalline material to become partially randomized at the selected region into which the ions of said first material are implanted.

17. A method as recited in Claim 16, wherein both the monocrystalline material and the ions of said first material are substantially composed of silicon.

18. A method as recited in Claim 1, wherein oxidizing said first material in said selected region is conducted at a pressure in the range of about 1 to 25 atmospheres.

19. A method as recited in Claim 1, wherein oxidizing said first material in said selected region is conducted at a pressure in the range of about 5 to 25 atmospheres.

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20. A method for forming an oxide region on a substrate assembly, the method comprising the steps of:

forming a hard mask over a volume of silicon of a substrate assembly;

forming an opening in the hard mask to expose a selected region of the volume of silicon;

bombarding the selected region of the volume of silicon with silicon ions through the opening in the hard mask so as to leave unaltered the electrical charge characteristics of the selected region of the volume of silicon; and

oxidizing the volume of silicon to form silicon dioxide substantially only at the selected region by exposure of the selected region to oxygen.

21. A method as recited in Claim 20, further comprising forming a spacer around the opening in the hard mask, said spacer extending from the volume of silicon to contact the hard mask, wherein said bombarding the selected region of the volume of silicon with silicon ions through the opening in the hard mask implants ions immediately adjacent to but not through the spacer around the opening in the hard mask.

22. A method as recited in Claim 21, wherein said forming a spacer around the opening in the hard mask comprises:

depositing layer of spacer material over the opening in the hard mask; and

anisotropically etching the layer of spacer material at the opening in the hard mask to form the spacer situated around the opening of the hard mask.

23. A method as recited in Claim 21, wherein the spacer around the opening in the hard mask is composed of silicon nitride.

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24. A method as recited in Claim 21, wherein the spacer is one of a pair of spacers, the ions being implanted in between but not through the pair of spacers and past the hard mask into the selected region of the volume of silicon, and wherein the selected region is situated between the pair of spacers, whereby the silicon dioxide is not substantially formed underneath the pair of spacers.

25. A method as recited in Claim 24, wherein the pair of spacers are separated by a distance in the range of about 0.05 micrometers to about 0.1 micrometers.

26. A method as recited in Claim 20, further comprising forming a pad oxide layer upon the volume of silicon prior to said forming a hard mask over a volume of silicon of a substrate assembly, the hard mask being formed upon the pad oxide layer, and said forming a hard mask over a volume of silicon of a substrate assembly comprising:

forming the hard mask upon the pad oxide layer; and

forming a photoresist mask over the hard mask; and wherein silicon dioxide is formed in the volume of silicon at the selected region beneath the opening in the hard mask.

27. A method as recited in Claim 26, wherein the photoresist mask is removed after the step of implanting ions.

28. A method as recited in Claim 26, wherein said etching the hard mask also etches through the pad oxide layer.

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29. A method as recited in Claim 20, wherein the substrate assembly is oriented within a major plane and wherein bombarding the selected region of the volume of silicon with silicon ions through the opening in the hard mask is conducted such that the direction that the ions are implanted into the selected region is substantially orthogonal to the major plane of the substrate assembly.

30. A method as recited in Claim 20, wherein oxidizing the volume of silicon to form silicon dioxide substantially only at the selected region by exposure of the selected region to oxygen further comprises heating the substrate assembly while exposing the substrate assembly to oxygen.

31. A method as recited in Claim 20, wherein the volume of silicon is substantially composed of monocrystalline silicon having a lattice structure, and wherein the implanted silicon ions in the monocrystalline silicon cause the lattice structure of the monocrystalline silicon to become partially randomized at the selected region into which the ions are implanted.

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32. A method for forming an oxide region on a substrate assembly, the method comprising the steps of:

forming a hard mask over a pad oxide layer situated on a volume of silicon of a substrate assembly, the substrate assembly being oriented within a major plane;

forming an opening in the hard mask to expose a selected region of the volume of silicon, said selected region of said volume of silicon being substantially composed of monocrystalline silicon having a lattice structure;

depositing layer of silicon nitride over the opening of the hard mask;

anisotropically etching the hard mask at the opening in the hard mask to form a pair of silicon nitride spacers situated on opposite sides of the opening of the hard mask, each said silicon nitride spacer extending from the volume of silicon to contact the hard mask;

implanting silicon ions between but not through the pair of silicon nitride spacers and through the opening in the hard mask into the selected region of the volume of silicon such that the direction that the silicon ions are implanted into the selected region is substantially orthogonal to the major plane of the substrate assembly, wherein the implanted silicon ions do not substantially alter the electrical charge characteristic of the selected region, and wherein the implanted silicon ions in the monocrystalline silicon in the selected region cause the lattice structure thereof to become partially randomized; and

heating the substrate assembly while exposing the substrate assembly to oxygen so as to form silicon dioxide at the selected region, whereby the silicon layer oxidizes faster where the silicon ions are implanted than where the silicon ions are not implanted.

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33. A method as recited in Claim 32, wherein the pair of spacers are separated by a distance in the range of about 0.05 micrometers to about 0.1 micrometers.

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34. A method for forming a trench isolation region on a substrate assembly, the method comprising:

forming a trench in a volume of semiconductor material substantially composed of a first material, said volume of semiconductor material being situated within a substrate assembly;

implanting ions of said first material into a surface of said trench;

oxidizing the surface of the trench by exposure thereof to oxygen to form a thermal oxide layer substantially composed of an oxide of said first material; and

filling the remainder of the trench with an insulating material.

35. A method as recited in Claim 34, wherein the ions of said first material comprise silicon ions.

36. A method as recited in Claim 35, wherein the first material is substantially composed of monocrystalline silicon.

37. A method as recited in Claim 34, wherein the substrate assembly is oriented within a major plane and said implanting ions of said first material is conducted such that the direction that the ions are implanted into the selected region is within ten degrees from a direction that is orthogonal to the major plane of the substrate assembly.

38. A method as recited in Claim 34, wherein said forming a trench in a volume of semiconductor material substantially composed of a first material is conducted as a single etching process that etches adjacent and substantially contiguous nitride, oxide, and silicon layers.

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39. A method as recited in Claim 34, wherein said oxidizing the surface of the trench is conducted at a pressure in the range of about 5 to 25 atmospheres.

40. A method as recited in Claim 34, wherein said forming a trench in a volume of semiconductor material substantially composed of a first material comprises:

forming a thin oxide layer on the in a volume of semiconductor material within the substrate assembly;

forming a layer of silicon nitride over the thin oxide layer;

forming a photoresist mask over the layer of silicon nitride; and

conducting a single etching process employing multiple etch recipes to etch the silicon nitride layer, the thin oxide layer, and the silicon substrate to form the trench.

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41. A method for forming a shallow trench isolation region on a substrate assembly, the method comprising:

forming a trench in a volume of monocrystalline silicon within a substrate assembly;

implanting silicon ions into a surface of the trench;

oxidizing the surface of the trench by exposure of the trench to oxygen so as to form silicon dioxide on the surface of the trench; and

filling the trench with silicon dioxide.

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42. A method for forming a shallow trench isolation region on a substrate assembly, the method comprising:

forming a thin oxide layer on a volume of silicon of a substrate assembly;

forming a layer of silicon nitride over the thin oxide layer;

forming a patterned photoresist mask over the layer of silicon nitride;

conducting an etching process that employs multiple etch recipes to etch the adjacent silicon nitride layer, the thin oxide layer, and the volume of silicon to form a trench in the volume of silicon;

implanting silicon ions into the trench, the silicon ions being implanted in a direction that is within ten degrees from a direction that is orthogonal to a plane of the substrate assembly;

oxidizing the surface of the trench by exposing thereof to oxygen at a pressure in the range of about 5 to 10 atmospheres so as to form a thermal oxide layer in the trench;

filling the remainder of the trench with silicon dioxide; and

removing the silicon nitride layer.

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